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10/773,204	02/09/2004	Kia Silverbrook	MTB16US	8271

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EXAMINER	
CHOI, HAN S	

ART UNIT	PAPER NUMBER
2853	

DATE MAILED: 04/12/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/773,204	SILVERBROOK, KIA	
	Examiner	Art Unit	
	Han S. Choi	2853	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-54* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-54* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *09 February 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *12/16/04*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Specification

1. Applicant is reminded of the proper language and format for an abstract of the disclosure.

The abstract should be in narrative form and generally limited to a single paragraph on a separate sheet within the range of 50 to 150 words. It is important that the abstract not exceed 150 words in length since the space provided for the abstract on the computer tape used by the printer is limited. The form and legal phraseology often used in patent claims, such as "means," "said," and "comprises" should be avoided. The abstract should describe the disclosure sufficiently to assist readers in deciding whether there is a need for consulting the full patent text for details.

The language should be clear and concise and should not repeat information given in the title. It should avoid using phrases which can be implied, such as, "The disclosure concerns," "The disclosure defined by this invention," "The disclosure describes," etc.

2. The abstract of the disclosure is objected to because the abstract contains the word "comprises" in line 1. Correction is required. See MPEP § 608.01(b).

Claim Objections

3. Claims 4, 22, and 41 objected to because of the following informalities: the word "nozzles" in line 2 of the stated claims should be changed to "nozzle" and the word "of" needs to be included in between the words "plurality" and "liquid" in line 3 of the stated claims. Appropriate correction is required.

Double Patenting

4. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the

unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

5. Claims 1-54 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1, 5-19, 23-38, and 42-54 of copending Application No. 10/773196 (Pub. No. US 2004/0155936) in view of Silverbrook (US Pat. 5,841,452) and Silverbrook (US Pat. 6,045,710).

The copending application contains the limitations of the pending application except for the nozzle unit cells manufactured using semiconductor and micro-mechanical techniques such that the spacing between adjacent nozzle apertures in the printhead is less than 100 and 80 microns, the nozzle unit cells are formed in a generally planar array, each cell being less than 40 microns wide and less than 70 microns long with respect to the plane of the array, and wherein a silicon wafer provides a support substrate for the array of the nozzle unit cells, the unit cells being formed on one side of the wafer, wherein a plurality of liquid supply passages extend from the

opposing side of the wafer to each of the nozzle unit cells respectively, the liquid passages extending substantially normal to the plane of the array.

Silverbrook ('452) of the acknowledged prior art teaches the nozzle unit cells manufactured using semiconductor and micro-electromechanical techniques in [Col. 1, Lines 62-64] such that the spacing between adjacent nozzle apertures in the printhead is less than 100 and 80 microns in [Col. 15, Lines 58-59] (the horizontal spacing between nozzles is 64 microns).

Silverbrook ('452) teaches the horizontal spacing of the nozzles [110] as 64 microns (one side of the delineated block is equal to 64 microns) as taught in [Col. 15, Lines 58-59]. Therefore, the drawn block on Fig. 42 has dimensions of 64 microns by 128 microns. The drawn block is equal to a cell. Silverbrook ('452) is silent on defining a "cell", but it is known that a cell comprises one nozzle and that a printhead array contains a number of "cells." Silverbrook ('452) does not teach the dimensions of each cell being less than 40 microns wide and less than 70 microns long with respect to the plane of the array. It would have been obvious at the time the invention was made to a person having ordinary skill in the art at the time the invention was made to have a cell dimension of less than 40 microns wide and less than 70 microns long in a printhead of the copending application since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ (CCPA 1980.)

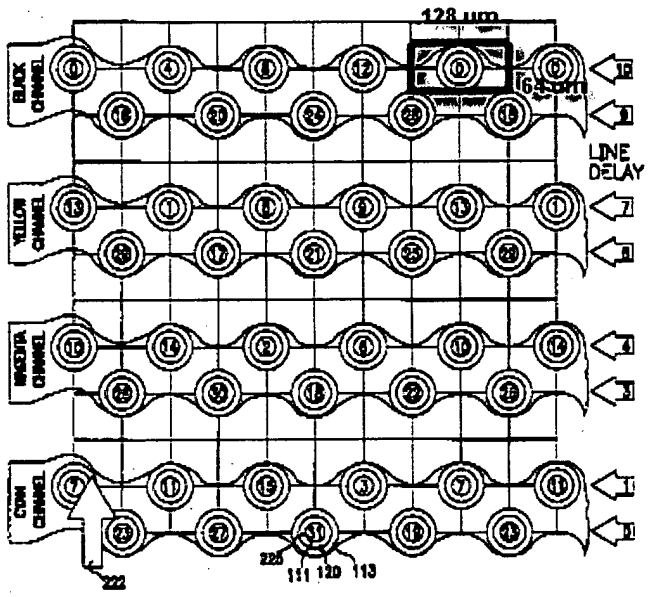

FIG. 42

Silverbrook ('710) teaches a silicon wafer [120] provides a support substrate for the array of the nozzle unit cells in Fig. 7, the unit cells being formed on one side of the wafer; wherein, a plurality of liquid supply passages extend from the opposing side of the wafer to each of the nozzle unit cells respectively in [Col. 37, Lines 55-63], the liquid passages extending substantially normal to the plane of the array shown in Fig. 7.

It would have been obvious at the time the invention was made to a person having ordinary skill in the art to incorporate the teachings of Silverbrook ('710) with the modified printhead of the copending application for the purpose of reducing the costs of manufacturing.

This is a provisional obviousness-type double patenting rejection.

Claim Rejections - 35 USC § 102

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

7. Claims 1, 2, 5, 6, 8, 13, 19, 20, 24, 25, 27, and 32 are rejected under 35 U.S.C. 102(b) as being anticipated by Silverbrook (US Pat. 5,841,452).

Referring to claims 1 and 19:

- an inkjet printhead and a printer system in [Col. 2, Lines 13-17]
- a plurality of nozzles in [Col. 2, Lines 6-7]
- each nozzle unit cell having a nozzle aperture [111] shown in Fig. 19.
- each nozzle [486] having a respective bubble forming chamber [488] in [Col. 10, Lines 4-9] in Fig. 18.
- a heater [440] disposed in each of the bubble forming chambers [447] respectively in [Col. 8, Lines 48-50] with corresponding drive circuitry in [Col. 2, Lines 43-45].
- at least one heater element [120] configured for thermal contact with a bubble forming liquid [106] in [Col. 10, Lines 14-16].
- heating the heater element to a temperature above the boiling point of the bubble forming liquid in [Col. 19, Lines 7-9] forms a gas bubble that causes the ejection of a drop of an ejectable liquid through the nozzle corresponding to that heater element shown in Fig. 18.

- the nozzle unit cells are manufactured using semiconductor and micro-mechanical techniques in [Col. 1, Lines 62-64]
- the spacing between adjacent nozzle apertures in the printhead is less than 100 microns in [Col. 15, Lines 58-59] (the horizontal spacing between nozzles is 64 microns).

Referring to claims 2 and 20:

- the spacing between adjacent nozzle apertures in the printhead is less than 80 microns in [Col. 15, Lines 58-59] (the horizontal spacing between nozzles is 64 microns).

Referring to claims 5 and 24:

- the bubble forming liquid and the ejectable liquid are of a common body of liquid shown in Fig. 17. (the ejected liquid [108] is separated from the bubble forming liquid)

Referring to claims 6 and 25:

- the printhead configured to print on a page and to be a page-width printhead in [Col. 2, Lines 28-31]

Referring to claims 8 and 27:

- typically 200 nanojoules is required to eject a drop by heating the heater element in [Col. 18, Lines 15-18].

Referring to claims 13 and 32:

- a thick chemical vapor deposition (CVD) glass over coat [142] which forms the nozzle region in [Col. 9, Lines 57-58] shown in Fig. 12.

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

9. Claims 3 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Silverbrook (US Pat. 5,841,452).

Silverbrook teaches the horizontal spacing of the nozzles [110] as 64 microns (one side of the delineated block is equal to 64 microns) as taught in [Col. 15, Lines 58-59]. Therefore, the drawn block on Fig. 42 has dimensions of 64 microns by 128 microns. The drawn block is equal to a cell. Silverbrook is silent on defining a "cell", but it is known that a cell comprises one nozzle and that a printhead array contains a number of "cells." Silverbrook does not teach the dimensions of each cell being less than 40 microns wide and less than 70 microns long with respect to the plane of the array. It would have been obvious at the time the invention was made to a person having ordinary skill in the art at the time the invention was made to have a cell dimension of less than 40 microns wide and less than 70 microns long in a printhead of Silverbrook since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ (CCPA 1980.)

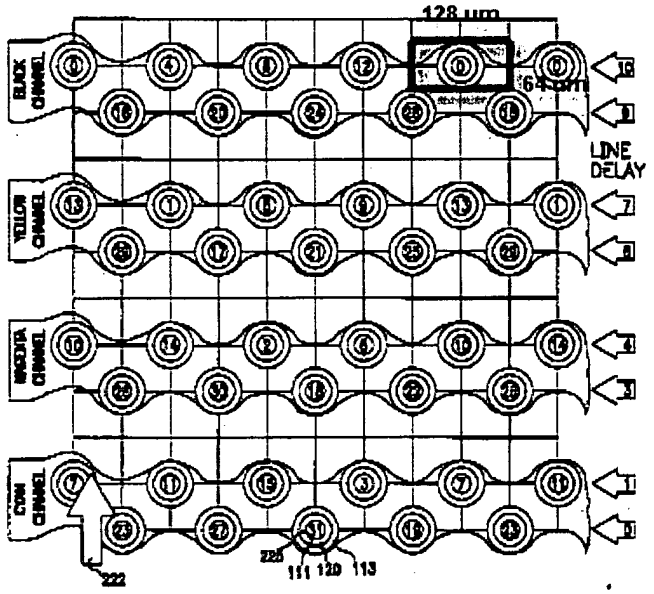

FIG. 42

10. Claims 4 and 22 rejected under 35 U.S.C. 103(a) as being unpatentable over Silverbrook (US Pat. 5,841,452) in view of Silverbrook (US Pat. 6,045,710).

Silverbrook ('452) discloses the basic elements of the claimed invention except for wherein a silicon wafer provides a support substrate for the array of the nozzle unit cells, the unit cells being formed on one side of the wafer, wherein a plurality of liquid supply passages extend from the opposing side of the wafer to each of the nozzle unit cells respectively, the liquid passages extending substantially normal to the plane of the array.

Silverbrook ('710) teaches a silicon wafer [120] provides a support substrate for the array of the nozzle unit cells in Fig. 7, the unit cells being formed on one side of the wafer; wherein, a plurality of liquid supply passages extend from the opposing side of

the wafer to each of the nozzle unit cells respectively in [Col. 37, Lines 55-63], the liquid passages extending substantially normal to the plane of the array shown in Fig. 7.

It would have been obvious at the time the invention was made to a person having ordinary skill in the art to incorporate the teachings of Silverbrook ('710) with the modified printhead of the Silverbrook ('452) for the purpose of reducing the costs of manufacturing.

11. Claims 7, 11, 18, 23, 26, 30, and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Silverbrook (US Pat. 5,841,452) in view of Kubby (US Pat. 5,706,041).

Silverbrook discloses the basic elements of the claimed invention except for the heater element is in the form of a cantilever beam, the heater element having two opposite sides and configured such that a gas bubble formed by the heater element is formed at both of the sides of the heater element, supporting the bubble forming liquid in thermal contact with each heater element and ejectable liquid adjacent each nozzle, and the heater element substantially covered by a conformal protective coating, all sides of the coating being seamless.

Kubby of the acknowledged prior art teaches the heater element in the form of a suspended or cantilever beam [18] in [Col. 3, Lines 53-55]. Kubby teaches the heater element [20a and 20b] causing a gas bubble to be formed on both sides of the heater element [20a or 20b] in [Col. 4, Lines 59-63]. Kubby teaches a configuration to support the bubble forming liquid in thermal contact with each said heater element, and to

support the ejectable liquid adjacent each nozzle in [Col. 3, Lines 13-24] shown in Fig. 2. Kubby teaches a heater element [20a or 20b] that is substantially covered by a protective coating substantially to all sides, which are seamless in [Col. 4, Lines 32-50] shown in Fig. 4.

It would have been obvious at the time the invention was made to a person having ordinary skill in the art to incorporate the elements taught by Kubby to the printhead of Silverbrook for the purpose of allowing ink to flow on two sides of the heating element, exposing both sides of the heater for vaporizing liquid ink, ejecting a sufficient amount of ink from the ejector, properly heating the ink, and protecting the heater.

12. Claims 16 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Silverbrook (US Pat. 5,841,452) in view of Chan (US Pat. 5,710,070).

Silverbrook discloses the basic elements of the claimed invention except for a heater element formed of solid material of which more than 90% of which, by atomic proportion, is constituted by at least one periodic element having an atomic number below 50.

Chan teaches a thermal inkjet printhead comprising a resistive layer composed of titanium nitride, which forms a resistor and a contact metal barrier layer in [Col. 2, Lines 10-14]. Titanium has an atomic number less than 50 on the periodic table.

It would have been obvious at the time the invention was made to a person having ordinary skill in the art to incorporate the titanium nitride resistor to the printhead

of Silverbrook for the purpose of having resistors that are more reliable, especially at higher temperatures and less complicated to manufacture.

13. Claims 9 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Silverbrook (US Pat. 5,841,452) in view of Silverbrook (US Pat. 5,856,836).

Silverbrook ('452) discloses the basic elements of the claimed invention except for the printhead configured to receive a supply of the ejectable liquid at an ambient temperature, wherein each heater element is configured such that the energy required to be applied to heat the heater element to cause ejection of an ink drop is less than the energy required to heat a volume of an ejectable liquid equal to the volume of the ink drop, from an ambient temperature to the boiling point.

Silverbrook ('836) teaches in [Col. 4, Lines 59-65] comprising a thermally activated liquid ink printing head being characterized by the energy required to eject a drop of ink being less than the energy required to raise the temperature of the received supply of ink of a volume equal to the volume of said ink drop above the ambient ink temperature to below ejection temperature. Ejection temperature is referred to in Claims 1 and 19 as the temperature above boiling point. Therefore, "below ejection temperature" would include the boiling point.

It would have been obvious at the time the invention was made to a person having ordinary skill in the art to incorporate the teaching of Silverbrook ('836) with the printhead of Silverbrook ('452) for the purpose of providing a higher nozzle density per

row, a manufacturing process for the printhead with low production costs, and to dissipate the full amount of the active power in the printed ink itself.

14. Claims 10 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Silverbrook (US Pat. 5,841,452) in view of Feinn et al. (US Pat. 6,543,879).

Silverbrook discloses the basic elements of the claimed invention except for a nozzle density greater than 10000 nozzles/cm^2.

Feinn et al. of the acknowledged prior art teaches in [Col. 2, Lines 1-14] a nozzle packing density of at least 100 nozzles/mm^2, which is equal to 10000 nozzles/cm^2 when converted to square centimeters.

It would have been obvious at the time the invention was made to a person having ordinary skill in the art to incorporate the nozzle density of Feinn et al. to the printhead of Silverbrook for the purpose of accommodating higher printing resolutions and to improve the printhead drop generation rate in [Col. 1, Lines 57-61].

15. Claims 12 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Silverbrook (US Pat. 5,841,452) in view of Keil et al. (US Pat. 6,447,104).

Silverbrook discloses the basic elements of the claimed invention except for the gas bubble collapsing to a collapse point spaced from the heater element.

Keil et al. teaches a bubble collapse occurring at a location well spaced from the heat transducer [34] in [Col. 4, Lines 48-56] shown in Figs. 3-5.

It would have been obvious at the time the invention was made to a person having ordinary skill in the art to incorporate the teaching of Keil et al. with the printhead of Silverbrook for the purpose of extending the life of the heat transducer [34].

16. Claims 14 and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Silverbrook (US Pat. 5,841,452) in view of Kashino et al. (US Pat. 5,534,898).

Silverbrook discloses the basic elements of the claimed invention except for a nozzle plate of the printhead having a thickness of less than 10 microns.

Kashino et al. of the acknowledged prior art teaches a thickness of an orifice plate in the order of several microns in [Col. 6, Lines 34-41].

It would have been obvious at the time the invention was made to a person having ordinary skill in the art to incorporate the thickness of the Kashino et al. nozzle plate to the Silverbrook printhead for the purpose of obtaining adequate values of the velocity of the discharged ink droplets, amount of ink droplet and refilling frequency, and in consideration of the distance between the thermal energy generating element and the discharge port.

17. Claims 15 and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Silverbrook (US Pat. 5,841,452) in view of Komuro (US Pat. 4,965,594).

Silverbrook discloses the basic elements of the claimed invention except for a plurality of nozzle chambers each corresponding to a respective nozzle, and a plurality

of said heater elements being disposed within each chamber, the heater elements within each chamber being formed on different respective layers to one another.

Komuro of the acknowledged prior art teaches heating resistors [11A, 21, and 31] of a first, second, and third layer formed on different respective layers and a plurality of nozzles [2] having chambers [4] with heaters [11A, 21, and 31] disposed within in [Cols. 3 and 4, Lines 25-68 and 1-34] shown in Figs. 1-4.

It would have been obvious at the time the invention was made to a person having ordinary skill in the art to incorporate the stated structure of Komuro with the printhead of Silverbrook for the purpose of keeping discharge speed and frequency characteristics in a stable manner.

18. Claims 17 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Silverbrook (US Pat. 5,841,452) in view of Pan et al. (US Pat. 4,931,813).

Silverbrook discloses the basic elements of the claimed invention except for the heater element configured to a mass of less than 10 nanograms.

Pan et al. discloses the heater element including a solid that is heated to form a bubble vapor to cause ejection of an ink drop, but does not explicitly teach the solid having a mass less than 10 nanograms. It would have been obvious at the time the invention was made to a person having ordinary skill in the art at the time the invention was made to apply at least 10 nanograms of the solid material to the heating element of Silverbrook to cause an ejection of an ink drop since it has been held that discovering

an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ (CCPA 1980.)

19. Claims 38, 39, 42, 43, 44, and 50 are rejected under 35 U.S.C. 103(a) as being unpatentable over Silverbrook (US Pat. 5,841,452) in view of Fukuchi et al. (US Pat. 4,549,191).

Referring to claim 38, Silverbrook discloses the basic elements of the claimed invention except for supplying the nozzle with a replacement volume of the ejectable liquid equivalent to the ejected drop.

Fukuchi et al. teaches replacing an amount equal in volume to the ink that was ejected from the nozzles in [Col. 1, Lines 35-38].

It would have been obvious at the time the invention was made to a person having ordinary skill in the art to incorporate the teaching of Fukuchi et al. with the printhead of Silverbrook for the purpose of preventing ink degeneration in the pressure chamber in [Col. 3, Lines 51-58].

Referring to claims 42, 43, 44, and 50, Silverbrook teaches the bubble forming liquid and the ejectable liquid are of a common body of liquid shown in Fig. 17. (the ejected liquid [108] is separated from the bubble forming liquid). Silverbrook teaches the printhead configured to print on a page and to be a page-width printhead in [Col. 2, Lines 28-31]. Silverbrook teaches that typically 200 nanojoules is required to eject a drop by heating the heater element in [Col. 18, Lines 15-18]. Silverbrook teaches a

thick chemical vapor deposition (CVD) glass over coat [142] which forms the nozzle region in [Col. 9, Lines 57-58] shown in Fig. 12.

20. Claim 40 is rejected under 35 U.S.C. 103(a) as being unpatentable over Silverbrook (US Pat. 5,841,452) in view of Fukuchi et al. (US Pat. 4,549,191).

Silverbrook in view of Fukuchi et al. teaches the horizontal spacing of the nozzles [110] as 64 microns (one side of the delineated block is equal to 64 microns) as taught in [Col. 15, Lines 58-59]. Therefore, the drawn block on Fig. 42 has dimensions of 64 microns by 128 microns. The drawn block is equal to a cell. Silverbrook in view of Fukuchi et al. is silent on defining a "cell", but it is known that a cell comprises one nozzle and that a printhead array contains a number of "cells." Silverbrook in view of Fukuchi et al. does not teach the dimensions of each cell being less than 40 microns wide and less than 70 microns long with respect to the plane of the array. It would have been obvious at the time the invention was made to a person having ordinary skill in the art at the time the invention was made to have a cell dimension of less than 40 microns wide and less than 70 microns long in a printhead of Silverbrook in view of Fukuchi et al. since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ (CCPA 1980.)

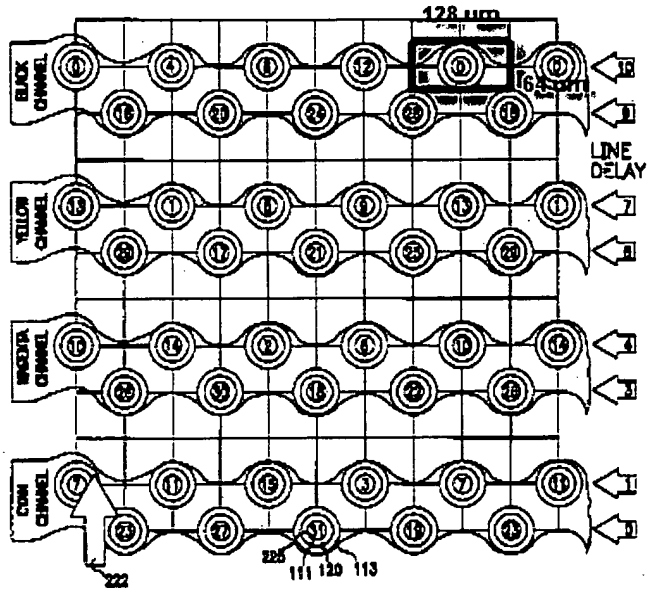

FIG. 42

21. Claim 41 is rejected under 35 U.S.C. 103(a) as being unpatentable over Silverbrook (US Pat. 5,841,452) in view of Fukuchi et al. (US Pat. 4,549,191) as applied to claim 38 above, and further in view of Silverbrook (US Pat. 6,045,710).

Silverbrook ('452) in view of Fukuchi et al. discloses the basic elements of the claimed invention except for wherein a silicon wafer provides a support substrate for the array of the nozzle unit cells, the unit cells being formed on one side of the wafer, wherein a plurality of liquid supply passages extend from the opposing side of the wafer to each of the nozzle unit cells respectively, the liquid passages extending substantially normal to the plane of the array.

Silverbrook ('710) teaches a silicon wafer [120] provides a support substrate for the array of the nozzle unit cells in Fig. 7, the unit cells being formed on one side of the

wafer; wherein, a plurality of liquid supply passages extend from the opposing side of the wafer to each of the nozzle unit cells respectively in [Col. 37, Lines 55-63], the liquid passages extending substantially normal to the plane of the array shown in Fig. 7.

It would have been obvious at the time the invention was made to a person having ordinary skill in the art to incorporate the teachings of Silverbrook ('710) with the modified printhead of the Silverbrook ('452) in view of Fukuchi et al. for the purpose of reducing the costs of manufacturing.

22. Claims 47 and 54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Silverbrook (US Pat. 5,841,452) in view of Fukuchi et al. (US Pat. 4,549,191) as applied to claim 38 above, and further in view of Kubby (US Pat. 5,706,041).

Silverbrook in view of Fukuchi et al. discloses the basic elements of the claimed invention except for the heater element having two opposite sides and configured such that a gas bubble formed by the heater element is formed at both of the sides of the heater element and the heater element substantially covered by a conformal protective coating, all sides of the coating being seamless.

Kubby teaches the heater element [20a and 20b] causing a gas bubble to be formed on both sides of the heater element [20a or 20b] in [Col. 4, Lines 59-63]. Kubby teaches a heater element [20a or 20b] that is substantially covered by a protective coating substantially to all sides, which are seamless in [Col. 4, Lines 32-50] shown in Fig. 4.

It would have been obvious at the time the invention was made to a person having ordinary skill in the art to incorporate the elements taught by Kubby to the printhead of Silverbrook in view of Fukuchi et al. for the purpose of exposing both sides of the heater for vaporizing liquid ink, ejecting a sufficient amount of ink from the ejector, and protecting the heater.

23. Claim 52 is rejected under 35 U.S.C. 103(a) as being unpatentable over Silverbrook (US Pat. 5,841,452) in view of Fukuchi et al. (US Pat. 4,549,191) as applied to claim 38 above, and further in view of Chan (US Pat. 5,710,070).

Silverbrook in view of Fukuchi et al. discloses the basic elements of the claimed invention except for a heater element formed of solid material of which more than 90% of which, by atomic proportion, is constituted by at least one periodic element having an atomic number below 50.

Chan teaches a thermal inkjet printhead comprising a resistive layer composed of titanium nitride, which forms a resistor and a contact metal barrier layer in [Col. 2, Lines 10-14]. Titanium has an atomic number less than 50 on the periodic table.

It would have been obvious at the time the invention was made to a person having ordinary skill in the art to incorporate the titanium nitride resistor to the printhead of Silverbrook in view of Fukuchi et al. for the purpose of having resistors that are more reliable, especially at higher temperatures and less complicated to manufacture.

24. Claim 45 is rejected under 35 U.S.C. 103(a) as being unpatentable over Silverbrook (US Pat. 5,841,452) in view of Fukuchi et al. (US Pat. 4,549,191) as applied to claim 38 above, and further in view of Silverbrook (US Pat. 5,856,836).

Silverbrook ('452) in view of Fukuchi et al. discloses the basic elements of the claimed invention except for the printhead configured to receive a supply of the ejectable liquid at an ambient temperature, wherein each heater element is configured such that the energy required to be applied to heat the heater element to cause ejection of an ink drop is less than the energy required to heat a volume of an ejectable liquid equal to the volume of the ink drop, from an ambient temperature to the boiling point.

Silverbrook ('836) teaches in [Col. 4, Lines 59-65] comprising a thermally activated liquid ink printing head being characterized by the energy required to eject a drop of ink being less than the energy required to raise the temperature of the received supply of ink of a volume equal to the volume of said ink drop above the ambient ink temperature to below ejection temperature. Ejection temperature is referred to in Claim 38 as the temperature above boiling point. Therefore, "below ejection temperature" would include the boiling point.

It would have been obvious at the time the invention was made to a person having ordinary skill in the art to incorporate the teaching of Silverbrook ('836) with the printhead of Silverbrook ('452) in view of Fukuchi et al. for the purpose of providing a higher nozzle density per row, a manufacturing process for the printhead with low production costs, and to dissipate the full amount of the active power in the printed ink itself.

25. Claim 46 is rejected under 35 U.S.C. 103(a) as being unpatentable over Silverbrook (US Pat. 5,841,452) in view of Fukuchi et al. (US Pat. 4,549,191) as applied to claim 38 above, and further in view of Feinn et al. (US Pat. 6,543,879).

Silverbrook in view of Fukuchi et al. discloses the basic elements of the claimed invention except for a nozzle density greater than 10000 nozzles/cm^2.

Feinn et al. of the acknowledged prior art teaches in [Col. 2, Lines 1-14] a nozzle packing density of at least 100 nozzles/mm^2, which is equal to 10000 nozzles/cm^2 when converted to square centimeters.

It would have been obvious at the time the invention was made to a person having ordinary skill in the art to incorporate the nozzle density of Feinn et al. to the printhead of Silverbrook in view of Fukuchi et al. for the purpose of accommodating higher printing resolutions and to improve the printhead drop generation rate in [Col. 1, Lines 57-61].

26. Claim 48 is rejected under 35 U.S.C. 103(a) as being unpatentable over Silverbrook (US Pat. 5,841,452) in view of Fukuchi et al. (US Pat. 4,549,191) as applied to claim 38 above, and further in view of Keil et al. (US Pat. 6,447,104).

Silverbrook in view of Fukuchi et al. discloses the basic elements of the claimed invention except for the gas bubble collapsing to a collapse point spaced from the heater element.

Keil et al. teaches a bubble collapse occurring at a location well spaced from the heat transducer [34] in [Col. 4, Lines 48-56] shown in Figs. 3-5.

It would have been obvious at the time the invention was made to a person having ordinary skill in the art to incorporate the teaching of Keil et al. with the printhead of Silverbrook in view of Fukuchi et al. for the purpose of extending the life of the heat transducer [34].

27. Claim 49 is rejected under 35 U.S.C. 103(a) as being unpatentable over Silverbrook (US Pat. 5,841,452) in view of Fukuchi et al. (US Pat. 4,549,191) as applied to claim 38 above, and further in view of Kashino et al. (US Pat. 5,534,898).

Silverbrook in view of Fukuchi et al. discloses the basic elements of the claimed invention except for a nozzle plate of the printhead having a thickness of less than 10 microns.

Kashino et al. of the acknowledged prior art teaches a thickness of an orifice plate in the order of several microns in [Col. 6, Lines 34-41].

It would have been obvious at the time the invention was made to a person having ordinary skill in the art to incorporate the thickness of the Kashino et al. nozzle plate to the Silverbrook in view of Fukuchi et al. printhead for the purpose of obtaining adequate values of the velocity of the discharged ink droplets, amount of ink droplet and refilling frequency, and in consideration of the distance between the thermal energy generating element and the discharge port.

28. Claim 51 is rejected under 35 U.S.C. 103(a) as being unpatentable over Silverbrook (US Pat. 5,841,452) in view of Fukuchi et al. (US Pat. 4,549,191) as applied to claim 38 above, and further in view of Komuro (US Pat. 4,965,594).

Silverbrook in view of Fukuchi et al. discloses the basic elements of the claimed invention except for a plurality of nozzle chambers each corresponding to a respective nozzle, and a plurality of said heater elements being disposed within each chamber, the heater elements within each chamber being formed on different respective layers to one another.

Komuro of the acknowledged prior art teaches heating resistors [11A, 21, and 31] of a first, second, and third layer formed on different respective layers and a plurality of nozzles [2] having chambers [4] with heaters [11A, 21, and 31] disposed within in [Cols. 3 and 4, Lines 25-68 and 1-34] shown in Figs. 1-4.

It would have been obvious at the time the invention was made to a person having ordinary skill in the art to incorporate the stated structure of Komuro with the printhead of Silverbrook in view of Fukuchi et al. for the purpose of keeping discharge speed and frequency characteristics in a stable manner.

29. Claim 53 is rejected under 35 U.S.C. 103(a) as being unpatentable over Silverbrook (US Pat. 5,841,452) in view of Fukuchi et al. (US Pat. 4,549,191) as applied to claim 38 above, and further in view of Pan et al. (US Pat. 4,931,813).

Silverbrook in view of Fukuchi et al. discloses the basic elements of the claimed invention except for the heater element configured to a mass of less than 10 nanograms.

Pan et al. discloses the heater element including a solid that is heated to form a bubble vapor to cause ejection of an ink drop, but does not explicitly teach the solid having a mass less than 10 nanograms. It would have been obvious at the time the invention was made to a person having ordinary skill in the art at the time the invention was made to apply at least 10 nanograms of the solid material to the heating element of Silverbrook in view of Fukuchi et al. to cause an ejection of an ink drop since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ (CCPA 1980.)

Conclusion

30. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The prior art reference (US Pat. 5,815,173) cited in PTO 892 form show elements that are deemed to be relevant to the present invention. This reference should be reviewed.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Han S. Choi whose telephone number is (571) 272-8350. The examiner can normally be reached on Monday - Friday, 8:30am to 5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen Meier can be reached on (571) 272-2149. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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